

E-election in Digital Society

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Abstract

Electronic Society today is one of main challenges of developing and developed countries. It plays a central role in the national development plans and thus many ICT based projects are dedicated to digital society development. In this regard, government organizations must reengineer their processes and structures to meet the e-government and e-society defined standards. All of these together will make processes electronically available to citizens and businesses and minimize physical attendance in organizations to get information and services.

This article focuses on specific and challengeable area of digital society called "electronic election". The authors try to combine the ICT enabled prerequisites to define a roadmap to move from traditional election process to pure electronic election. To do so, differences between traditional and electronic election are defined and different scenarios of partial e-election are introduced. The case being considered is the process of annual trade union election within Trade Organization (TTO), the subsidiary of Ministry of Commerce. The paper describes how it can be performed via electronic channels using Election Markup language (EML), a standard suitable and efficient to reengineering the traditional election.

Keywords: *Electronic Election, Electronic Markup Language (EML), e-election Readiness, e-election roadmap and e-election framework.*

1. Introduction

E-election is a major issue in both e-government and digital society domains because of its requirements and impacts on the government and society. Modern voting systems in developed and democratic societies have been diffused in

different forms like electronic voting, kiosk voting, remote electronic voting, online voting or Internet voting (or i-voting) from 1990 to 2008[1, 2]. However, to the best of authors' knowledge, no precise and seamless guideline exists to support e-election deployment (not limited to e-voting) in developing countries. Democracy level and e-readiness vary with the developing country.

The governmental authorities of Iran have made efforts to modernize the conventional election system at the national level using ICT potentials. The implementation of e-government and move to digital society in Iran has received the attention of authorities and policy makers since 1990. The e-government national plan is a comprehensive strategic plan that describes the road to e-government vision. The main strategies are rightsizing the government, changes in managerial systems and structures, human resource development and drawing a citizen orientation plan [3]. Accordingly, governmental organizations are expected to make processes electronically available and to minimize physical attendance of citizens and business representatives in organizations to get information and service.

This article, first, focuses on the annual trade union election and the standard set by the Organization for the Advancement of Structured Information Standards (OASIS) to provide insights required for modernizing the election systems using electronic channels and processes. Then, the specifications of traditional and electronic elections are described and stages of move from t-election to e-election are defined.

2. Research Methodology

TTO is a governmental organization with a wide range of subsidiaries and trade unions that govern trade related

activities [4] and relies more on traditional processes to perform activities. A survey was conducted in Fall 2007 in Tehran Trade Organization (TTO); the structured survey, intended for each trades' chief administrative officer, was conducted via mail and face to face interview. Survey responses were collected on the election processes, main challenges of traditional election system and managers expectations from e-election system; feedbacks received from both future candidates as well as the election executive team members.

The forms were analyzed and the traditional election workflow was recognized and documented. To standardize the election process, all common standards were surveyed and EML was selected as a comprehensive and precise framework to reshape the election.

The traditional election process reengineered by the EML based framework was proposed. The main prerequisites of (e-election) development based on EML and e-government prerequisites merged to meet the e-election development requirements [5]. Then, the road to achieve the seamless e-election system was defined as the e-election development roadmap. Figure 1 shows the main steps of this research.

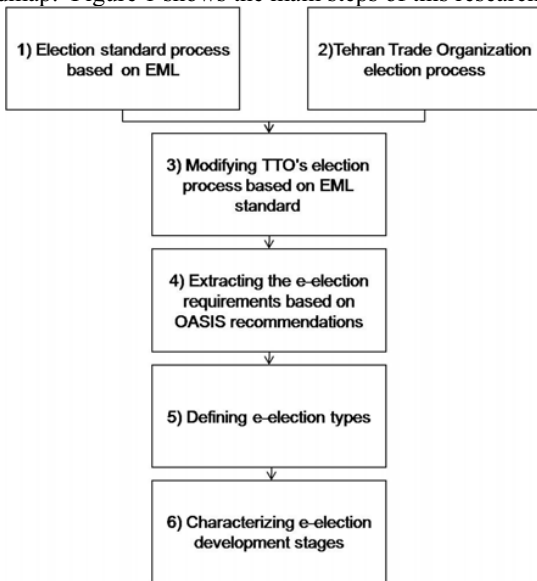


Figure 1: Research Steps

In this research, all 6 steps have been analyzed for TTO, and consequently, the implementation of e-election for the annual TTO election has been planned.

3. Election process in TTO

The annual trade unions election has been done on the basis of people custom using non-automatic methods. The government and the TTO have important roles to direct the election process by helping firm trade unions, law enactment and finding the appropriate patterns from all corners of the

world; however, election experiences shows that traditional and manual methods have sever drawbacks in real world. The aim of this paper is to find a framework which shifts the traditional election to agile and flexible e-election that can answer to the new dynamic and unpredictable users and policy makers needs [6].

Having studied the current election processes, interviews with TTO managers and trade unions, the authors worked out the strengths and weaknesses of the traditional methods used.

The strengths of the traditional election systems are:

1. Policies common in trade unions are clear and well known to the traders.
2. Current procedures seem easy and practical due to evolutionary changes resulted from past elections.
3. Implementation costs of the existing methods appear to be affordable and acceptable in short term, if compared against modern methods.
4. Current methods have grasped the trust of candidates and voters.
5. The organizational structure have adapted to the needs of traditional election method.
6. No need for modern technologies, skills, procedures, regulations, etc.

The weaknesses of the traditional election systems are:

1. The election process is time consuming.
2. The accuracy rate is questionable.
3. participation rate is relatively low due to complex procedures
4. Training costs spent on personnel is high due to high number of staff.
5. Need to physical attendance is a barrier for those who are far away from the voting center.
6. Time & place are barriers in the eyes of voters and candidates.
7. Data analysis which is useful for managerial decisions is so complex that seems impractical.

All these strengths and weaknesses led the TTO managers to study development and use of the e-election system for conducting the annual trade unions election. As a result, the procedures were redefined using EML standard; and it appears to us that they may be useful for similar cases [7].

4. OASIS EML standard

OASIS formed the election and voter Services Technical Committee in Spring 2001 to develop standards for election and voter information services using XML. Figure 2 demonstrates the whole e-election process provided by EML. This high-level process model is derived from real world election experiences. For clarity, the whole process can be divided into 3 major areas, pre election, election, and post election; each area involves one or more election processes. This document allocates an ID number to each process. One or more XML schema will be specified to support each process; this ensures consistency with all the figures and the schemas required.

E-election standard schema describes TTO e-election desired situation. All processes, standards, integration policies, security issues, e-election devices and system behavior clarified in EML form the TTO's to-be e-election system.

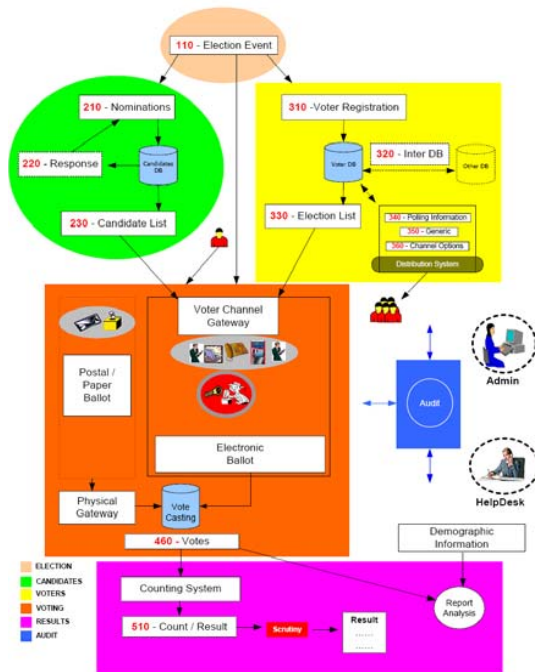


Figure 2: e-election standard schema

As shown in the Figure 2, the three major areas incorporate sub processes. The pre election process consists of 3 sub processes, i.e. election, candidates and voters. The election process is elaborated to voting sub process. Post election as a sensitive and complicated process consists of results, audit and analysis. Some functions belong to the whole process and not to a specific area.

EML standard helps us reengineer and improve the traditional election process. This high-level process model is derived from real world election experiences and it is designed to accommodate feedbacks and inputs from the members of OASIS e-election committee ().

The main processes in Figure 2 are listed below:

- Pre election ⁽¹¹⁰⁾
 - Election ⁽²⁰⁰⁾
 - Candidates ⁽²¹⁰⁾
 - Nomination ⁽²²⁰⁾
 - Response to nomination ⁽²³⁰⁾
 - Candidate List ⁽³⁰⁰⁾
 - Voters ⁽³¹⁰⁾
 - Voter registration ⁽³²⁰⁾
 - Interdatabase communication ⁽³³⁰⁾
 - Election List
 - Voter Communication
 - Polling information ⁽³⁴⁰⁾
 - Generic ⁽³⁵⁰⁾
 - Voter Notification ⁽³⁶⁰⁾
- Election ⁽⁴⁰⁰⁾
 - Voting ⁽⁴¹⁰⁾
 - Ballot ⁽⁴¹⁰⁾
 - Authentication ⁽⁴²⁰⁾
 - Authentication Reply ⁽⁴³⁰⁾
 - Vote Confirmation ⁽⁴⁵⁰⁾
 - Votes ⁽⁴⁶⁰⁾
- Post election ⁽⁵⁰⁰⁾
 - Counting ⁽⁵¹⁰⁾
 - Count Result ⁽⁵¹⁰⁾
 - Audit
 - Analysis
- Global functions
 - Administration Interface
 - Help Desk

5. Traditional election versus electronic election

E-election systems such as Internet based ones, in order to be accepted by a large user community, should guarantee the basic properties of traditional election systems, i.e. voters' anonymity and eligibility and vote secrecy; and they should offer additional advantages that could favor their acceptance. The pure e-election system will be based on the following properties:

- Location independence, where users can vote from any location (public voting sites or at home) through access the Internet with a computer. This is realized by design and implementing a voting protocol based on PKI (Public Key Infrastructure) to ensure privacy and eligibility
- Support by a security system against attacks, user friendliness of the interface and ease of installation

in order to facilitates uniqueness and integrity of the election system

- Device, equipping different voting places with suitable voting Kiosks and other required tools.

In this paper, e-election diffusion in the information society is recognized as the attendance of voters, election process and e-election devices. These main parameters help to distinguish the election situation from traditional to pure electronic election.

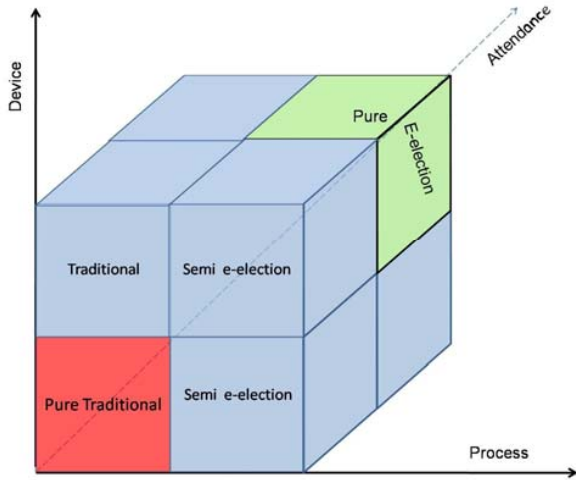


Figure 3: The categorization of election

The three dimensional cube in Figure 3 represents different stages between pure traditional election and pure electronic election. Each stage is defined further in Table 1.

Table 1: E-election types description factors

Election	Process	Attendance	Device	Description
Pure Traditional	0	0	0	<ul style="list-style-type: none"> • No e-election automation exists • No digital signature possibilities • No kiosks or terminals for e-election
Semi Electronic	1	0	0	<ul style="list-style-type: none"> • Some/ All e-election processes are automated • No digital signature possibilities • No kiosks or terminals for e-election
Traditional	0	1	0	<ul style="list-style-type: none"> • No e-election automation exists • Digital signature makes it possible to vote from any where • No kiosks or terminals for e-election

Election	Process	Attendance	Device	Description
Traditional	0	0	1	<ul style="list-style-type: none"> • No e-election automation exists • No digital signature possibilities • e-election terminals and kiosks are used
Semi Electronic	1	1	0	<ul style="list-style-type: none"> • Some/ All e-election processes are automated • Digital signature makes it possible to vote from any where • No kiosks or terminals for e-election
Semi Electronic	1	0	1	<ul style="list-style-type: none"> • Some/ All e-election processes are automated • No digital signature possibilities • e-election terminals and kiosks are used
Traditional	0	1	1	<ul style="list-style-type: none"> • No e-election automation exists • Digital signature makes it possible to vote from any where • e-election terminals and kiosks are used
Pure Electronic	1	1	1	<ul style="list-style-type: none"> • All e-election processes are automated • Digital signature makes it possible to vote from any where • e-election terminals and kiosks are used

5. E-election requirements

Promoting the infrastructure will become increasingly important throughout the country for national elections and within the organization for organizational elections. The provision of sustainable broadband services for the entire population will be emphasized. In order to realize e-election objectives, it will certainly be necessary to promote broadband services as well as e-election required hardware, software and databases. Moreover, the national promotion strategy should be combined with election organization initiatives in order to eliminate bottlenecks on e-election development as effectively as possible.

However, this will require regular monitoring of ICT status at the national level. Additionally, the culture of e-election needs to be promoted in the public. The authorities must help people vote with trust; the candidates and voters must be convinced on the efficiency and security of e-election system. Security considerations of e-voting systems include authentication, privacy/confidentiality, integrity and non-repudiation which will be realized using digital certificate and digital signature. The other main requirements are the e-election standards for various stages from designing the e-election processes to implementing the total system.

E-election Phases Development Prerequisites	Pre election	Election		Post election														
		Candidates	Voters	Vote	Result	Audit	Analysis											
					Election legislation	Candidates	Voters	Vote	Result	Audit	Analysis							
												Candidates	Voters	Vote	Result	Audit	Analysis	
																		Candidates
Network speed & Quality	e-payment	e-election Apps	Integrated Database	Access to Internet	Election kiosks and terminals	Standards like EML	Election regulations	Authentication	Cyber crime	Civil Liability	Privacy	Media	Public Awareness	Training	.Trust	Network and kiosks security	E-signature	
Technical Readiness		Laws and Regulation		Awareness		Security												
Not important		Optional		Important														

Table 2 is designed to help the policy makers become familiar with e-election critical bottlenecks and prerequisites. Additionally, the authority responsible for planning and implementation of e-election will use it to develop the road map by focusing on these indicators [11].

Figure 4 proposes a generic development path for e-election deployment at the country level. It indicates that in the earlier stages, the prime focus is on improving e-readiness

E-participation

High

LOW

Undeveloped E-infrastructures Developed

Stage1
Vision, strategies and initiatives are developed

Stage2
E-election website is running. Pre election application is developed, some information are available online

Stage3
E-election application is developed and available on website. Election terminals are networked to central agency

Stage4
E-election is alive. All pre election, election and post election processes are performed online and e-signature is available

Each stage is defined using certain requirements of election that are described below:

No electronic forms exist, candidates information is registered on papers. No website exists to deliver information. In this stage, the three sub processes are managed manually and no software package for this purpose exists. However, e-election laws and regulations may exist or being developed. The policies required for transferring to e-election desired vision is developed and the projects are defined.

The e-election online presence comprises a web page and /or an official website; the candidate registration is fulfilled

online. The pre election application is designed and developed. The pre election application is integrated to the e-payment service. Links to ministries/departments involved e.g. trade, labor and finance may/may not exist; archived information such as the election policies, laws and regulation, reports, newsletters, downloadable databases and previous elections information or documents may be available on line; most information remains static with the fewest options for users.

Stage 3: the presence of online election

In this stage, election application is developed and all election processes are conducted on line. Because of the e-signature lack, authorizing both voters and candidates must be performed in voting terminals, i.e. kiosks, election offices, etc. The voting terminals are networked to the election central agency. The central agency website is developed and voters and candidates obtain access to the latest election statistics without customization and personalization facilities. The interaction between the agency and end users is not allowed.

Stage 4: e-election is alive

In this stage, the goals of e-election are realized. It allows users to customize the election results for example by candidates. E-signature (based on PKI) exists and authentication is performed online. All election applications are integrated and are available at the election portal. Feedbacks and claims about the result are recorded online. Electronic relationship between the agency and end users exists e.g. via e-mail and Mobile SMS. In this stage, e-participation indicator will rise to the maximum level possible.

10. Conclusions

In this article, the authors tried to analyze TTO election rules and procedures in order to formulate the move from traditional election to pure electronic election. For this purpose, all strategic required components and actions are identified and put together to workout a generic roadmap. The roadmap is a general and comprehensive approach to achieve pure e-election stage with no concentration on the specifications of a target group (election case). E-election emphasizes on promoting equal digital opportunities, avoiding new forms of exclusion, ensuring all parts of communities can enjoy high-quality e-election services and making e-election accessible to everyone.

The roadmap is designed to realize an Internet based election services that will provide all citizens, not only those who are Internet enabled, with a tool for expressing their own opinion. The election system relies upon PKI technology for its correct operation and will enable us to use modern technologies such as smart cards for voting operations. It will also address the issues of trust and confidence over the Internet by users involved in online voting.

The Information Society offers more and more on-line services mostly via the Internet, most of which are business oriented, such as e-commerce or e-banking. However, tools for e-participation are becoming more common, such as forums and voting systems. Above all the technical challenges, user engagement and their trust in the system, demands further research.

10. References

- [1] Caltech-MIT Voting Technology Project, "Voting - What is, What Could Be", July 2001.
- [2] California Internet Voting Taskforce, "A Report on the Feasibility of Internet Voting", January 2000.
- [3] Supreme Council of Information technology Management, "National e-government development plan", 2005. Available at www.scict.com
- [4] Tehran Trade Organization, "trade union's election law and regulation", 2008, available at www.Asnaf.ir
- [5] OASIS, "Election MARK-UP Language (EML): e-VOTING PROCESS AND DATA REQUIREMENTS", Election and Voter Services technical committee, 2008.
- [6] Hall, T. and Alvarez, M., "American Attitudes about Electronic Voting Results of a National Survey", Center for Public Policy & Administration, University of Utah, September 2004.
- [7] Done, R.S., "Internet voting: bringing elections to the desktop", The PricewaterhouseCoopers Endowment for the Business of Government. E-government Series, 2002, February.
- [8] The Center of International Development (CID), Harvard University, "Readiness for the Networked World: A guide for developing countries", 2003, available at: <http://cyber.law.harvard.edu/readinessguide/guide.pdf> 2002
- [9] Computer System Policy Project (CSPP), "Guide to Global Electronic Commerce Readiness", 2005, http://www.cspp.org/projects/cspp_gec/index2.html www.cspp.org
- [10] InfoDev, "E-Ready for What? E-Readiness in Developing Countries: Current Status and Prospects toward the Millennium Development Goals", 2005, available at: www.readinessguide.org
- [11] Internet Policy Institute, Mote, Report of the National Workshop on Internet "Voting: Issues and Research Agenda", C.D., 2001.
- [12] UN Department of Economic and Social Affairs Division for Public Administration and Development Management "From E-government to E-inclusion", Global E-government Readiness Report, 2007.